NON-WOVEN INORGANIC FIBRE MAT

This invention relates to a non-woven inorganic fibre mat such as a glass fibre mat and to a method and apparatus for the production thereof. It also relates to the use of the mat in building boards, such as gypsum building boards.

A particularly useful form of building board is known as glass reinforced gypsum board (GRG). GRG board and its manufacture is described in GB-A-2 053 779. GRG board is of generally conventional appearance and is composed of a gypsum with a non-woven glass mat immediately below one or both principal surfaces. The mat is introduced into the core by vibrating the core slurry, over- or underlain by the mat, to cause it to pass through the mat, so that the surface layer or layers of gypsum are integral with the core. GRG boards are stronger than conventional boards and exhibit superior fire resistance.

In the manufacture of GRG board the need to provide strength by employing non-woven glass fibre mat of relatively low diameter (for example, 13μm) fibres conflicts with the need to ensure efficient exhaustion through the mat of air from the gypsum slurry from which the board is formed; this is a particular problem at the edge margins of the board where the bottom mat is brought up and onto the upper surface of the board to define the edges of the uncut board. Inefficient exhaustion of air in this region can lead to voids in the edge margins of the cut boards, reducing the edge strength of the boards.

The problem of voids in the edge margins has been dealt with by increasing the fibre diameter of the mat, particularly the bottom mat (to for example 16μm), allowing easier exhaustion of air and penetration of gypsum slurry but reducing board strength. However, the use of higher diameter fibres has been found to decrease the strength of the mat. Reduction of the mat substance (weight/unit area), which would allow the gypsum slurry to

penetrate the mat more readily, would lead to an unacceptable reduction in board strength.

The need to allow sufficient time for the gypsum slurry to penetrate the mat means that the line speed of the plasterboard manufacturing line is lower than would be the case were adequate exhaustion of air from the edge margins easier.

It has been desired to provide a GRG building board which can be manufactured at relatively high speed, is of high strength by virtue of using a mat of relatively low diameter fibres and the edge margins of which have a low level of voids.

According to the invention there is provided a non-woven mat of inorganic fibre having a substance (weight/unit area) which varies in the cross direction.

Preferably, the edge margins are of lower substance than the remainder of the mat.

Also, according to the invention there is provided a method of making a non-woven mat of inorganic fibre having a substance which varies in the cross direction comprising:

passing a forming wire past a slurry of inorganic fibres in a liquid while masking a part of the width of the forming wire as it passes through the slurry, the masking varying along the length of the forming wire as it passes through the slurry; and

urging the slurry against the forming wire and causing the said liquid to pass through the forming wire, whereby a non-woven mat of inorganic fibre is formed having an uneven substance in the cross direction (the cross direction is the direction on the mat generally perpendicular to the direction in which the mat runs through the machine, which is the machine direction).

Also according to the invention there is provided apparatus for forming a non-woven mat of inorganic fibre having a substance which varies in the cross direction comprising:

a source of a slurry of inorganic fibre in a liquid;

a forming wire disposed to move past the said source, through which, in use, the said liquid passes to deposit the said

inorganic fibre on the forming wire;

a mask across a part of the width of the forming wire to hinder passage of the said liquid through the forming wire over the said part, the effectiveness of the mask varying in the direction of movement of the forming wire past the said source.

Preferably, the mask is disposed across portion of the forming wire corresponding to the edge margins of the formed mat.

Also preferably, the effectiveness of the mask decreases in the direction in which the forming wire is disposed to move.

Also preferably, the mask is a blinding plate impinging the face of the forming wire remote from the source of slurry.

Also preferably, the effective width of the blinding plate decreases in the direction in which the forming wire passes the slurry.

The invention also provides a cementitious board having a sheet of a non-woven mat of inorganic fibre according to the invention embedded immediately below at least one surface.

In a further aspect, the invention also provides a cementitious board having a sheet of a non-woven mat of inorganic fibre embedded immediately below at least one surface wherein the permeability of the mat to cementitious slurry varies across the mat.

The invention will be further described by way of example, with reference to the drawings in which:

Figure 1 shows, diagrammatically, a perspective view of an inclined wire glass fibre mat former embodying the invention;

Figure 2 shows a blinding plate for use in the apparatus and method of the invention; and

Figure 3 shows a cross sectional view through a glass fibre mat according to the invention.

The former shown in Figure 1 comprises a flowbox 10 containing an aqueous slurry of chopped glass fibre and conventional additives up to the level indicated by the broken line 12. The slurry is continuously supplied to the flowbox 10

from below. A continuous forming wire 14, shown transparent in Figure 1 for clarity, passes through the flowbox 10 at angle to the vertical and the horizontal in the direction shown by the arrow in Figure 1. Slurry is drawn through the wire 14 and into a suction box 16 by a conventional slurry pumping system to form a mat 18 of glass fibres on the wire. Shortly after leaving the flowbox 10, the forming wire 14 carrying the mat 18 of fibres passes over a vacuum header 20 which draws water from the mat 18. The mat 18 on the forming wire 14 then has adhesive applied to it and is dried and wound into a roll, in a conventional manner. The other rollers and the frame shown in Figure 1 are conventional.

Blinding plates 22,22', shown also in Figure 2, are placed in the flowbox 10 between the edge margins of the forming wire 14 and the suction box 16; the forming wire 14 passes across their surface. The blinding plates 22,22' are generally rectangular with a rectangular cut out 24,24' from their inside downstream (relative to the forming wire 14) corner. The presence of the blinding plates 22,22' as the wire starts to pass over the suction box 16 prevents the passage of slurry through the forming wire 14 in the region underlain by the blinding plates and so no glass fibres accumulate on the wire. As the wire 14 passes over the cut outs 24,24' from the blinding plates, slurry passes through the edge margins of the wire previously underlain by the blinding plates and glass fibre mat accumulates. The central portion of the forming wire 14 is not masked at all by the blinding plates 22,22', and so the glass fibre mat accumulates there throughout the passage of the forming wire over the suction box.

The effect of this differential accumulation of glass fibres is to make a mat having edge portions 26,26' of lower substance (weight/unit area) than the central portion 28. This may be seen in Figure 3. The substance of the edge margins 26,26' of the mat can be controlled by the size of the cut-outs 24,24' from the blinding plates 22,22' and the position of the blinding plates relative to the suction box 16. Factors such as the

concentration of fibres in the slurry, the speed of the forming wire and the speed with which the slurry is drawn through the forming wire, which generally affect the deposition of fibres on the wire and thus the substance of the mat will also affect the substance of the edge margins 26,26' of the mat 18.

Glass fibre mats according to the invention find particular application in the manufacture of GRG board, described in GB-A-2 053 779. The mat is introduced into the core by vibrating the core slurry, over- or underlain by the mat, to cause it to pass through the mat, so that the surface layer or layers of gypsum are integral with the core. The lower substance of the edge margins of the mats allow air trapped in the slurry to pass readily through the edge margins of the mat. This avoids the formation of undesirable voids in the edge margins of the board, improving edge strength. Preferred mats for this purpose are of 13 μm diameter glass fibres and have a central substance of about 60 g/m^2 and an edge margin substance of about 27 g/m^2.

Blinding plates of the invention may be of any desired size and shape to achieve the desired substance distribution across the width of the mat. They may be located at one or both edge margins of the forming wire 14, or one or more may be disposed across the width of the wire. The blinding plates may rest on the wire or be otherwise disposed over the wire but are preferably under it, between it and the suction box 16.

Instead of separate blinding plates, deposition of fibres on the forming wire can be inhibited by treating the wire itself, for example by painting over small areas in regions of the wire to be masked, so that less slurry passes through the wire in these regions, reducing the fibre deposition and thus mat substance. Alternatively, the weave of the forming wire can be made closer in some regions, again reducing the flow of slurry through these regions.

The mats of the invention allow the provision of GRG type plasterboard of improved strength especially at the edge margins.

Plasterboard having the same strength edge margins as current GRG boards can be manufactured at higher speeds than are currently possible.